

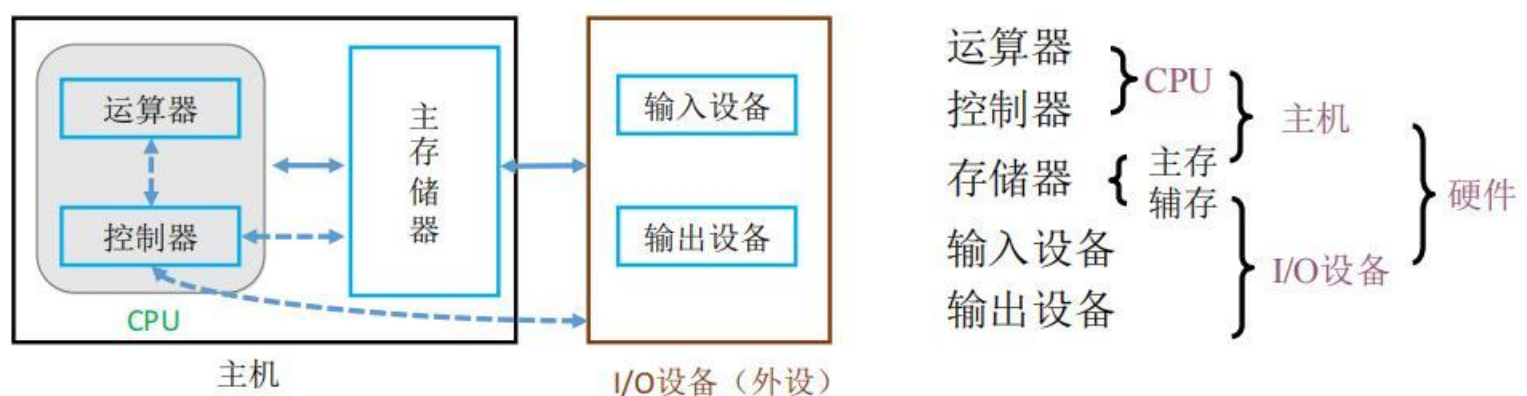
王道考研——组成原理

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第三章 存储系统

1

现代计算机的结构



品牌：华为 (HUAWEI)

商品名称：华为P40 Pro

CPU型号：麒麟990 5G

摄像头数量：后置四摄

分辨率：全高清FHD+

热点：液冷散热，人脸识别，无线...

商品编号：100012015134

运行内存：8GB

后摄主摄像头：5000万像素

屏幕比例：19.6~20:9

操作系统：其它OS

商品毛重：0.54kg

机身存储：128GB

前摄主摄像头：3200万像素

屏幕前置组合：其他

游戏配置：液冷散热

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本节内容

存储系统

基本概念

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3

知识总览

存储系统基本概念

存储器的层次结构

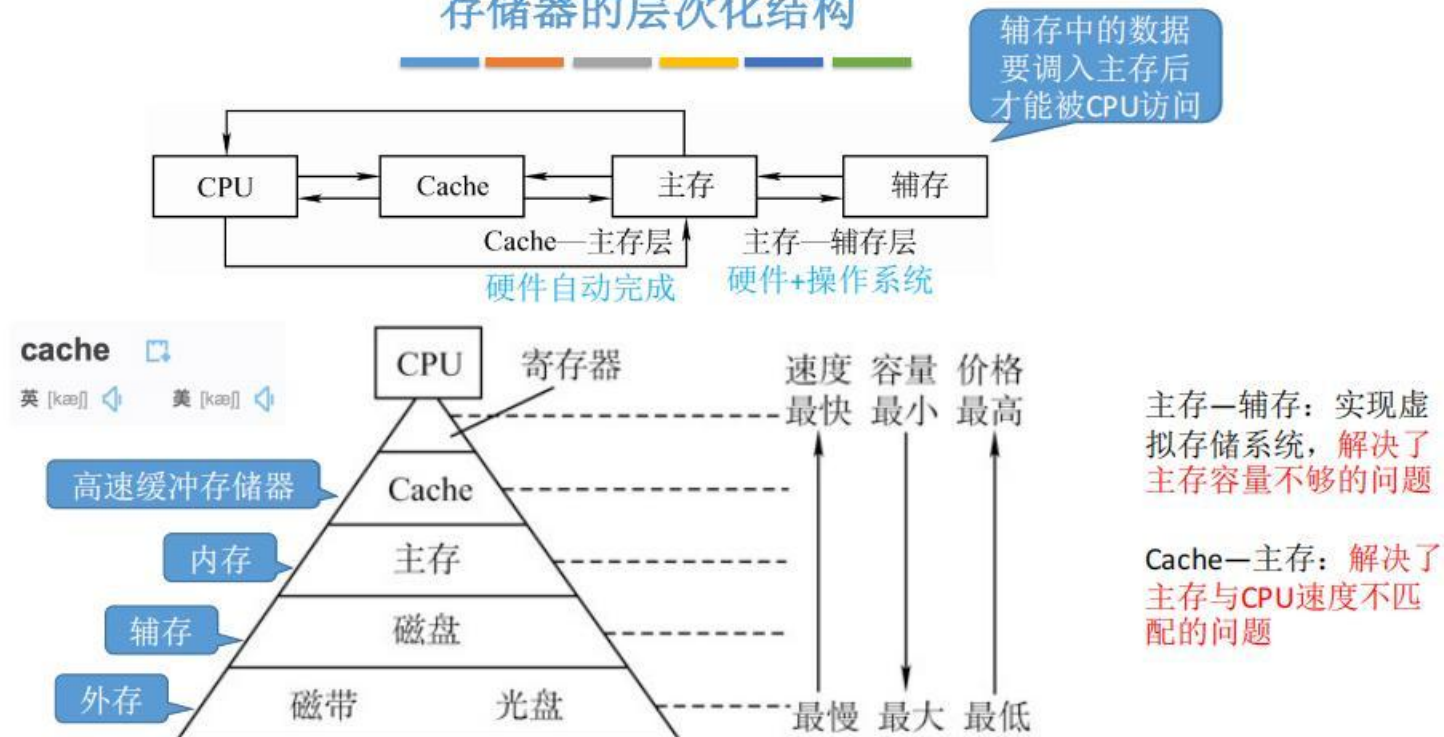
存储器的分类（从不同角度进行分类）

存储器的性能指标

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存储器的层次化结构



注: 有的教材把安装在电脑内部的磁盘称为“辅存”, 把U盘、光盘等称为“外存”。
也有的教材把磁盘、U盘、光盘等统称为“辅存”或“外存”

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各层存储器的速度与价格



SAMSUNG



¥259.00

三星 SAMSUNG 笔记本内存条 8G DDR4 2666 内存条 三星原厂正品内存, 让您更

AIDA64 Cache & Memory Benchmark 三星内存京东自营企业购

	Read	Write	Copy	Latency
Memory	37051 MB/s	37566 MB/s	31781 MB/s	61.1 ns
L1 Cache	988.09 GB/s	497.62 GB/s	992.73 GB/s	1.0 ns
L2 Cache	399.35 GB/s	243.65 GB/s	296.69 GB/s	3.1 ns
L3 Cache	249.92 GB/s	163.07 GB/s	208.80 GB/s	13.5 ns
CPU Type	QuadCore Intel Core i5-9300H (Coffee Lake-H, BGA1440)			
CPU Stepping	U0			
CPU Clock	3988.3 MHz (original: 2400 MHz, overlock: 66%)			
CPU FSB	99.7 MHz (original: 100 MHz)			
CPU Multiplier	40x	North Bridge Clock		3689.2 MHz

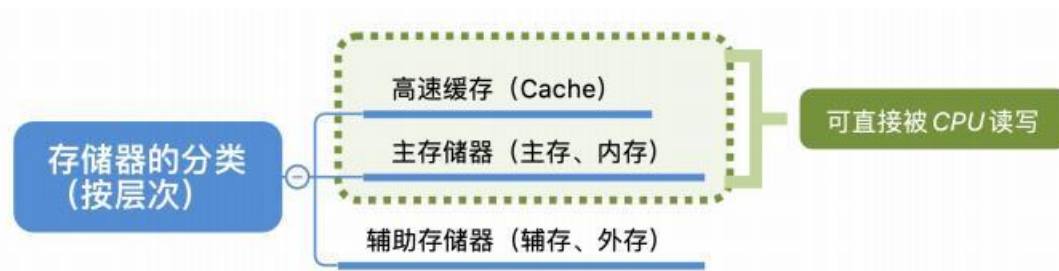
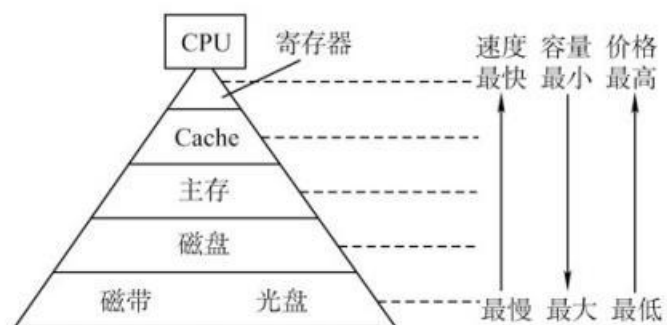
m.2接口的SSD读写速度可达4GB/s



¥549.00

三星 (SAMSUNG) 500GB SSD固态硬盘 SATA3.0接口 (B100, B105, B106, B107, B108, B109, B110, B111, B112, B113, B114, B115, B116, B117, B118, B119, B120, B121, B122, B123, B124, B125, B126, B127, B128, B129, B130, B131, B132, B133, B134, B135, B136, B137, B138, B139, B140, B141, B142, B143, B144, B145, B146, B147, B148, B149, B150, B151, B152, B153, B154, B155, B156, B157, B158, B159, B160, B161, B162, B163, B164, B165, B166, B167, B168, B169, B170, B171, B172, B173, B174, B175, B176, B177, B178, B179, B180, B181, B182, B183, B184, B185, B186, B187, B188, B189, B190, B191, B192, B193, B194, B195, B196, B197, B198, B199, B200, B201, B202, B203, B204, B205, B206, B207, B208, B209, B210, B211, B212, B213, B214, B215, B216, B217, B218, B219, B220, B221, B222, B223, B224, B225, B226, B227, B228, B229, B230, B231, B232, B233, B234, B235, B236, B237, B238, B239, B240, B241, B242, B243, B244, B245, B246, B247, B248, B249, B250, B251, B252, B253, B254, B255, B256, B257, B258, B259, B260, B261, B262, B263, 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存储器的分类——层次



王道考研/CSKAOYAN.COM

7

存储器的分类——存储介质

存储器的功能：存放二进制信息

1	0	1	0	1	1	0	1

按存储介质分类

2. 磁表面存储器：磁盘、磁带



以磁性材料存储信息

1. 半导体存储器 (主存、Cache)



以半导体器件存储信息

3. 光存储器



以光介质存储信息

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存储器的分类——存取方式

相联存储器（Associative Memory），即可以按内容访问的存储器（Content Addressed Memory, CAM）

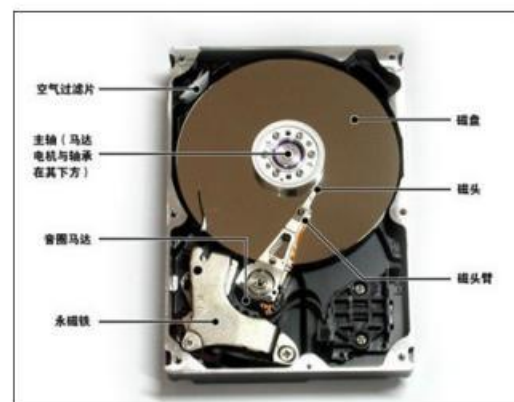
可以按照内容检索到存储位置进行读写，“快表”就是一种相联存储器



随机存取存储器（Random Access Memory, RAM）：读写任何一个存储单元所需时间都相同，与存储单元所在的物理位置无关



顺序存取存储器（Sequential Access Memory, SAM）：读写一个存储单元所需时间取决于存储单元所在的物理位置



直接存取存储器（Direct Access Memory, DAM）：既有随机存取特性，也有顺序存取特性。先直接选取信息所在区域，然后按顺序方式存取。

串行访问存储器：读写某个存储单元所需时间与存储单元的物理位置有关

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存储器的分类——信息的可更改性

读写存储器（Read/Write Memory）——即可读、也可写（如：磁盘、内存、Cache）

只读存储器（Read Only Memory）——只能读，不能写（如：实体音乐专辑通常采用 CD-ROM，实体电影采用蓝光光碟，BIOS通常写在ROM中）

事实上很多ROM也可多次读写，只是比较麻烦



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存储器的分类——信息的可保存性

断电后，存储信息消失的存储器——易失性存储器（主存、Cache）
断电后，存储信息依然保持的存储器——非易失性存储器（磁盘、光盘）

信息读出后，原存储信息被破坏——破坏性读出（如DRAM芯片，读出数据后要进行重写）
信息读出后，原存储信息不被破坏——非破坏性读出（如SRAM芯片、磁盘、光盘）

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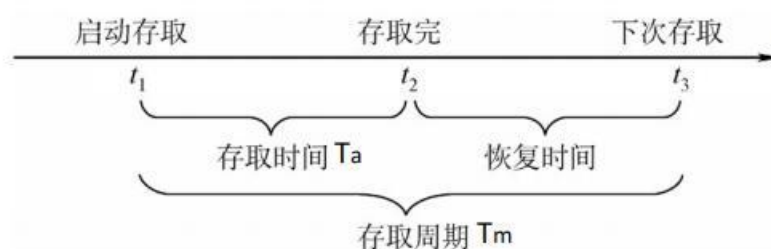
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存储器的性能指标

1. 存储容量：存储字数 \times 字长（如1M \times 8位）。
2. 单位成本：每位价格=总成本/总容量。
3. 存储速度：数据传输率=数据的宽度/存储周期。

MDR位数反映存储字长

数据的宽度即存储字长



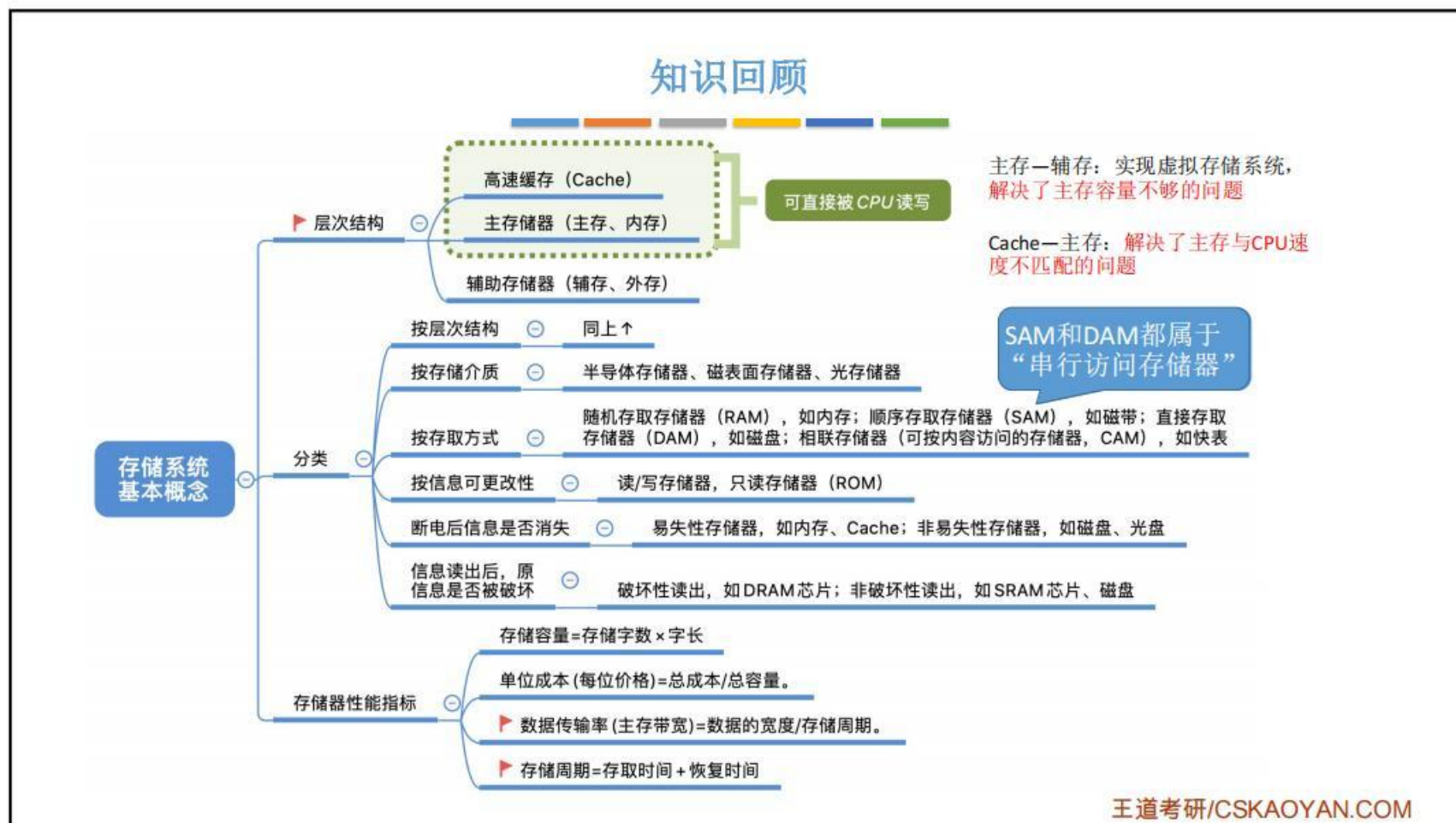
① 存取时间（ T_a ）：存取时间是指从启动一次存储器操作到完成该操作所经历的时间，分为读出时间和写入时间。

② 存取周期（ T_m ）：存取周期又称为读写周期或访问周期。它是指存储器进行一次完整的读写操作所需的全部时间，即连续两次独立地访问存储器操作（读或写操作）之间所需的最小时间间隔。

主存带宽（ B_m ）：主存带宽又称数据传输率，表示每秒从主存进出信息的最大数量，单位为字/秒、字节/秒（B/s）或位/秒（b/s）。

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